CHAPTER – 5
DETAILS OF MINING AREA

The occurrence of lignite from many parts of Gujarat has been reported as early as 1946 by Venkatappaiah of Geological Survey of India. The first lignite mining project was initiated in the year 1974, at Panandhro of Kachchh district by G.M.D.C. Ltd. The lignite at Panandhro is used as fuel at the thermal power plant installed near the mine area. The logic of exploiting lignite is due to the acute shortage of the good quality coal in the thermal power plants. The second lignite project was started by G.M.D.C. Ltd. in the year 1983, at Rajpardi in Bharuch district of South Gujarat region. Rajpardi lignite is used in the small scale industries of Ankleshwar – Bharuch areas as a fuel in textile, brick and pottery, paper and board, agro and food, pharmaceutical, chemical and fertilizer industries.

5.1 Exploration history

Rajpardi lignite was reported by O.N.G.C. during oil exploration programme. Subsequent to this, the then Directorate of Geology and Mining and now Commissionarate of Geology and Mining carried out further exploration in the region and established the available lignite reserves. Typical litholog of the study area is shown in the figure 5.1.

5.2 Lignite and other associated minerals

Apart from lignite, silica sand and clays have also been recovered as by products and are utilized for different purposes. Details of the lignite seams between Amod, Bhuri and Maljipura block is depicted in the fence diagram (Figure 5.2). It is observed that the Bhuri and Amod blocks have two major seams, the lower seam extended till Maljipura. Apart from these two major seams, there are smaller lignite pockets, observed in the borehole data from different location.

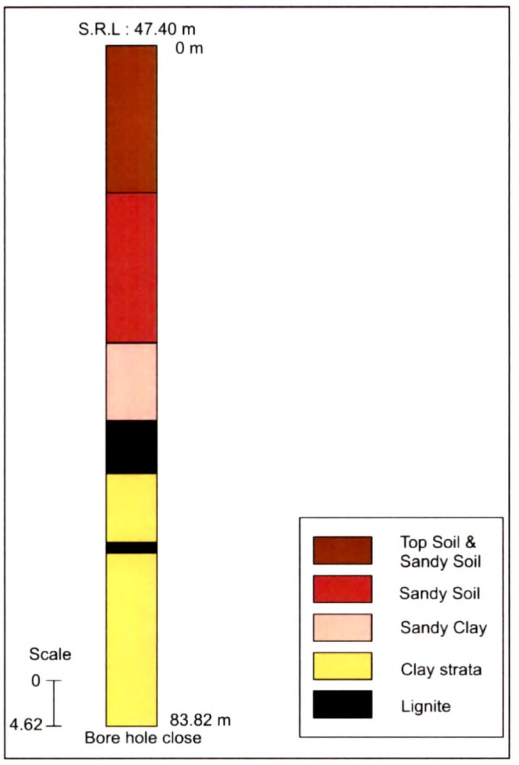

Figure 5.1: Litholog of lignite and overburden at the study area near Amod block

The data (source G.M.D.C., Ltd.) for Rajpardi is presented below;

a) Details of lignite occurrence in the study area is as follows:

(i) Geological Reserve: 41.50 million tons at Amod and Bhuri leases.

(ii) Economical Reserve : 11.75 million tons at Amod and 10.5 million tones at Bhuri (For cutoff stripping ratio of 1:15 and within 100m)

(iii) Reserve : 6.33 million tons for Amod block; For Bhuri data is not available (For stripping ratio of 1:10 and deeper then 100m)

(iv) Total moisture content : 20 – 32.5 wt. %

(v) Ash content : 10 – 15 wt. %

(vi) Volatile matter : 30 – 50 wt. %

(vii) Fixed carbon : 15 – 28 wt. %

(viii) Sulphur content : 0.5 – 1.0 wt. %

(ix) Calorific value:

- with moisture content : 3500 – 4000 kcal/kg
- on dry basis : 4500 – 5500 kcal/kg

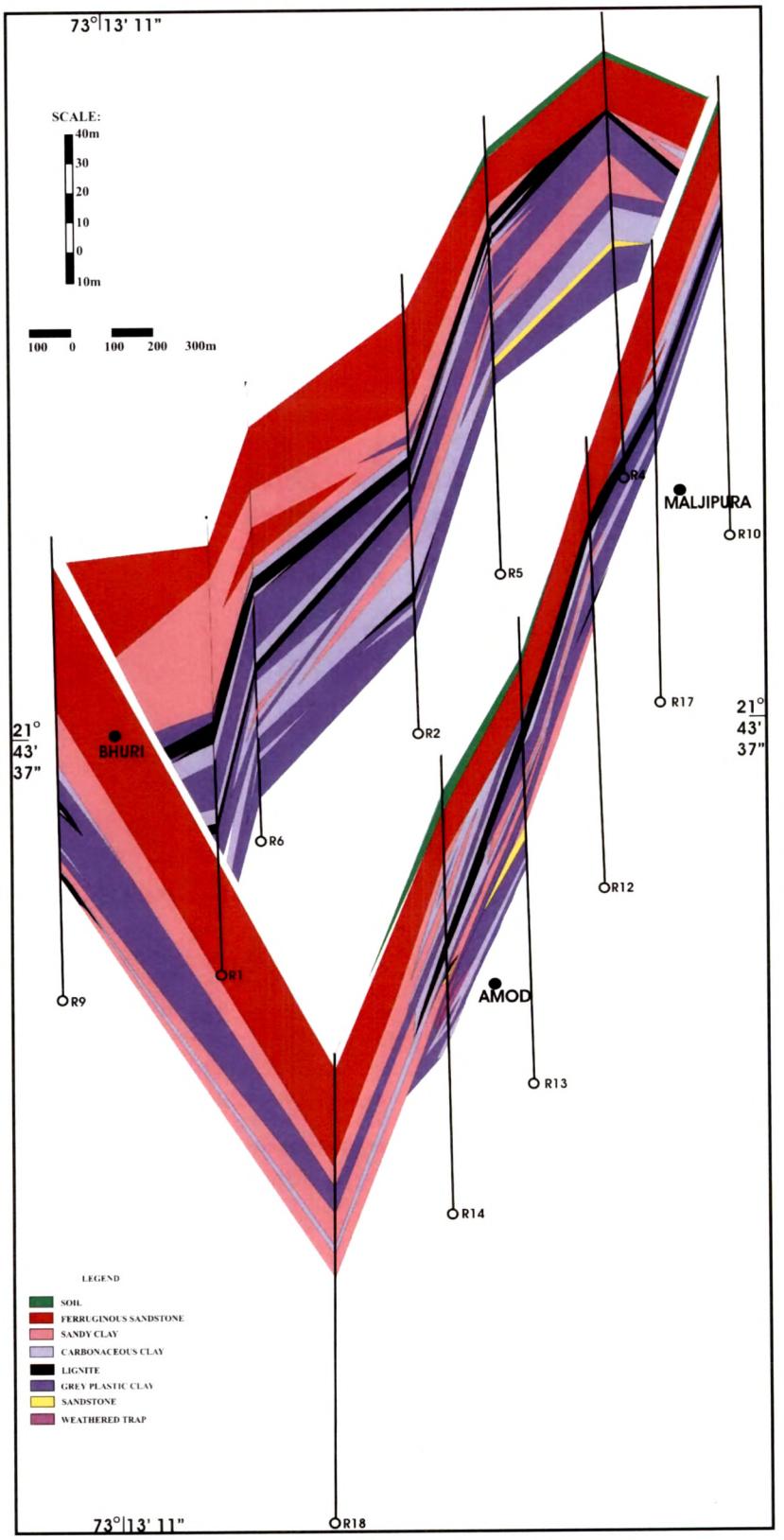

Figure 5.2: Fence diagram depicting disposition of lignite seams in the study area (modified after Kathiara *et. al.*, 1968)

b) The other associated minerals namely, silica sand and clays, have the following characteristics:

- Silica Sand: Good quality, commercial grade silica is recovered from the Tertiary sedimentaries overlying the lignite seams. The reserves have not been estimated, however, more than 3,666,654 metric tons of silica sand has already been sold to the glass and foundry industries. There is a need to estimate the total silica sand reserve for the purpose of royalty and systematic mining.

- Clays: Clay bands also occur above the lignite seams. These clays are light grey in color, have fair plasticity and hold up to 38.52% water and maintain the plastic behaviour. The linear shrinkage of these clays is 5%. Ball clays are having some potential for commercial use.

5.3 Mineable lignite

Based on the techno-economic considerations, the mineable and non-mineable lignite is determined by the mining technology in use, thickness of seams and lignite/overburden ratio. In the case of Rajpardi mine, following criteria has been adopted,

(i) Cut off thickness $\geq$ 0.5 m

(ii) Cut off depth $\leq$ 100 m

(iii) Cut off stripping ratio $\leq$ 1:15

However, for the lignite occurring deeper then 100 m the cut-off criteria is slightly changed; the lignite seam having thickness of 1 m or more and stripping ratio of 1: 10 is considered as mineable. Based on these considerations, the mineable lignite reserves are 11.16 million tons after taking into account 5% loss due to mining operation. Some lignite is locked up along the drainage, roads and in the adjoining leased areas. The estimated head of locked up reserve is 1.46 million tons, leaving only 9.70 million tons as net mineable lignite for Amod block. The Bhuri block is almost exhausted.

5.4 Mining method

The Rajpardi lignite mine is an open cast and highly mechanized mine, utilizing latest mining equipments. The soft overburden consists of Tertiary formations and does not require blasting operations. The excavations are mainly done using hydraulic excavators.

5.4.1 Bench configurations

Owing to the soft and low cohesive strength overburden, bench height and width of 5m is considered as stable and safe configuration. Further every fourth bench is given additional 10m extra width, making it 15m wide bench for greater slope stability. For the benches where the development and advancing face is present, the width of bench varies between 20m to 30m for facilitating the mining operation.

5.4.2 Overburden dumping

Hydraulic excavators of 2.5 to 3 m^3 bucket capacity are used to remove overburden, for haulage, dumpers of 25 ton to 35 ton capacity are used, the distribution of dumping sites are determined based on the ground conditions, ease in the trafficability and condition of lignite seams subsurface (Figure-5.3). Overburden dump is later used for backfilling of mined pits, for the restoration of landscape. The reclamation of mining area has already started from northern part of the mine. The silica sand rich overburden and useful clay bands are separately dumped for beneficiation, after beneficiation the remaining dump is utilized for back filling.

To control the surface runoff and erosion from these dumps, garland drains are created around each dump. Wherever, the dumps slopes have become stable plantation has been done. The average slope for the dump stability is taken as 30^{o}. Annexure 2 and 3 (Bhatt, 2002) shows plantation details over dumps in the mine area.

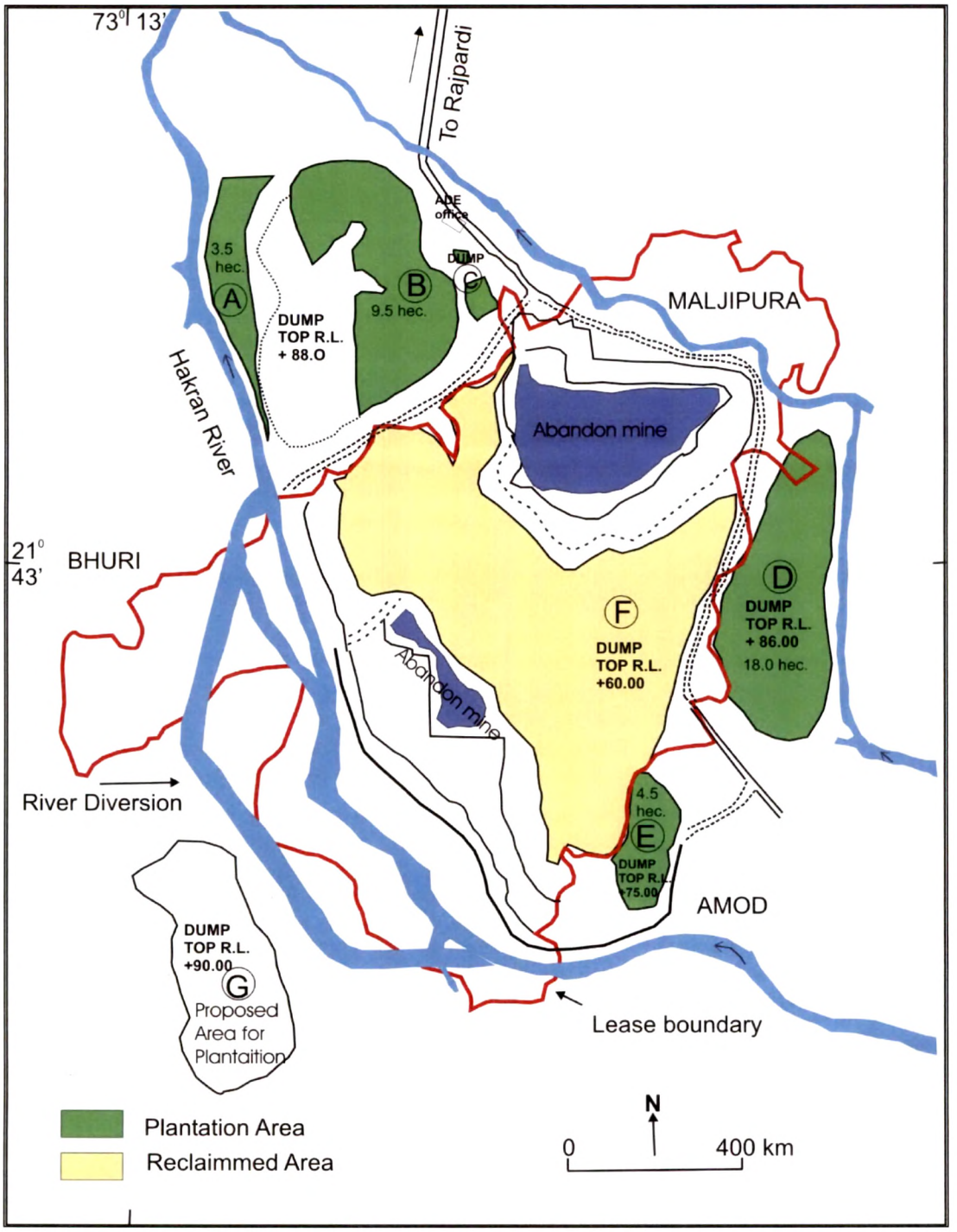

Figure 5.3: Rajpardi mine map showing dump sites and plantation details (After Bhatt, 2002)

5.5 Production of lignite

The five yearly production profile of the Amod block is shown below (Table 5.1). The average stripping ratio is 1:13 as evident from the data. The life of mine is 12 years (After Bhatt, 2002) for the assumed average annual production of 10, 00,000 ton/year. As shown in the Table 5.1, the desired lignite overburden ratio of 1:15 is achieved by 3rd year onward and the target production of 10, 00,000 tons/year is attained by fifth year of mining.

Table 5.1: Lignite production profile for five years (after Bhatt, 2002)

Year	Lignite Production (tones)	Overburden Removal (m^3)	Stripping Ratio
1st Year	1,00,000	50,00,000	1:50
2nd Year	3,00,000	50,00,000	1:67
3rd Year	5,00,000	70,00,000	1:14
4th Year	7,00,000	70,00,000	1:10
5th Year	10,00,000	100,00,000	1:10
Total	**26,00,000**	**340,00,000**	**1:13**

5.6 Hakran stream diversion

To win the locked lignite and preventing the surface water inflow into the mining pit, the Hakran stream is diverted from its natural course to the SW direction as shown in the figure 5.3. As the stream is a seasonal, there is hardly any impact visualized on the downstream ecology, however, there is an increase in the sediment load due to induced change in the course.